

APPENDIX H
HYDROLOGY DRAINAGE STUDY



HYDROLOGY DRAINAGE STUDY

The Ocean Avenue Project

101 Santa Monica Blvd.
Santa Monica, CA 90401
KPFF Job # 1800134

May 2020

CLIENT:

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Summary

The primary objective of this report is to analyze and compare the existing and proposed urban runoff of the proposed mixed use development located at 101 Santa Monica Boulevard in the City of Santa Monica for drainage from the building sites to the public right-of-way to demonstrate adequacy of the City's existing storm drain system. The project site encompasses two adjacent sites: the Ocean Avenue Parcel which is about 1.2 acres and the Second Street Parcel which is about 0.69 acres. The two parcels are separated by a public alley. Cumulatively the project is approximately 2 acres and is currently developed with commercial buildings, surface parking lots and landscaped areas. The proposed Project includes new buildings for a hotel, residential units, retail facilities, restaurants, public amenities and subterranean parking. It is our understanding that all existing structures and site features will be demolished as a part of the project.

Existing Drainage Areas & Characteristics

As previously mentioned, the project site is approximately 2 acres. Based on a schematic survey from the conceptual package prepared by Gehry Partners LLP, dated on February 1, 2018, there is an approximate 4.5-foot elevation change over a span of 350 feet. This results in a gradient of 1.3% from northwest to southeast. Based on existing elevations, runoff discharges to Santa Monica Boulevard and Ocean Avenue. Sheet flow on Santa Monica Boulevard and Ocean Avenue moves south, through existing gutters, where it is captured by existing catch basins on Ocean Avenue and Santa Monica Boulevard. According to the City of Santa Monica, the project is within the pier watershed which is conveyed to the stormwater tank located at 1543 Ocean Front Walk and is ultimately conveyed to the Santa Monica Urban Runoff Recycling Facility (SMURRF).

Drainage areas are defined in Exhibit 1: Existing Hydrology. Full hydrology calculations for the existing condition can be found in Appendix B.

Proposed Drainage Areas & Characteristics

Runoff from the site will consist mostly of roof runoff. The remainder of the runoff will also consist of stormwater from the surface lot. The proposed roof runoff will be captured by roof



drains, while the proposed surface runoff throughout the site will be intercepted by local area drains. The runoff will be adequately conveyed to the storm drain network below ground. The underground pipe network will then convey the collected stormwater runoff into a Best Management Practice (BMP) that has been chosen based on the criteria laid out by the City of Santa Monica Urban Watershed Management Program and geotechnical recommendations and requirements. As the project area is considered by the City as an “area of special consideration” due to the proximity of bluffs, available options for urban runoff management will be onsite rainwater collection designed to capture a 0.75-inch storm event and non-potable water use or to pay urban runoff reduction fee in-lieu of a post construction BMP.

The site has been designed to overflow via surface runoff to Santa Monica Boulevard and Ocean Avenue, therefore the proposed surface drainage patterns have been used to calculate runoff from a 10-year, 25-year and 50-year frequency storm.

Based on the Preliminary Geotechnical Report by Geotechnologies Inc., dated on May 1, 2018, the groundwater was encountered at 62.5 feet below site grade. Therefore, it is not likely that the site will require permanent dewatering for the subsurface levels of the proposed building.

Drainage areas are defined in Exhibit 2: Proposed Hydrology. Full hydrology calculations for the proposed conditions can be found in Appendix C.

Methodology

LA County's HydroCalc Calculator was used to determine the existing and proposed peak runoff rates for the 10, 25 and 50-year storm events for each of the drainage subareas; it is industry standard to assess 10-year, 25-year and 50-year events. HydroCalc is a software based on the Modified Rational Method (MODRAT), as outlined by the Los Angeles County Public Works Department Hydrology Manual, dated January 2006. The runoff equation for the Rational Method is as follows:

$$Q = C I A$$

where: Q = Peak runoff rate (cfs)

C = Runoff coefficient

I = Average rainfall intensity (in/hr)

A = Drainage area (acres)

The 50-year, 24-hour rainfall depth for the project is 6-inches. The 10-year 24-hr rainfall depth and 25-year 24-hour rainfall depth was determined by applying a factor of 0.714 and 0.878 respectively, to the 50-year, 24-hour rainfall depth per the Los Angeles County Public Works Department Hydrology Manual/Table 5.3.1. The 10-year, 24-hour rainfall depth is 4.28 inches. Furthermore, the 25-year, 24-hour rainfall depth is 5.27 inches. The soil type is 013 for the whole site.

The peak flow rate for each of the drainage areas was calculated using estimated impervious and pervious runoff coefficient and time of concentrations. Input parameters are provided on the existing and proposed hydrology in Exhibits 1 and 2.

The 10, 25 and 50-year existing and proposed peak discharges for the site are summarized in Table 2.1 below. The *HydroCalc* peak flow hydrologic analysis outputs are provided in Appendix B and C.

TABLE 2.1: SUMMARY OF 10, 25 and 50-YEAR PEAK FLOWS

Drainage Area	Area (ac)	Flow Path Length (ft)	Flow Path Slope (%)	% Existing Impervious	% Proposed Impervious	Existing Q (cfs)	Proposed Q (cfs)	Peak Flow Delta
10-Year								
DA1	0.69	200	1.5%	100	90	1.59	1.59	0
DA2	1.20	350	1.1%	95	92	2.35	2.35	0
25-Year								
DA1	0.69	200	1.5%	100	90	1.95	1.95	0
DA2	1.2	350	1.1%	95	92	3.12	3.12	0
50-Year								
DA-1	0.69	200	1.5%	100	90	2.22	2.22	0
DA-2	1.2	350	1.1%	95	92	3.87	3.87	0

Note: DA-1 represents the Second Street Parcel and DA-2 represents the Ocean Avenue Parcel

Summary and Assumptions

A comparison of existing and proposed percent of imperviousness shows that the overall percent of imperviousness decrease from 100% to 90% in the Second Street Parcel and decreases from 95% to 92% in the Ocean Avenue Parcel. Per the modified rational method, there is no net decrease or increase in the Second Street Parcel and the Ocean Avenue Parcel by the proposed development caused by a 10-year storm, 25-year and 50-year storm as shown on Table 2.1 above. Runoff would continue to follow the same discharge paths and drain to the same existing storm water systems. Additionally, this project will incorporate permanent BMPs that will reduce the discharge offsite. Therefore, the proposed development will not adversely impact the current public drainage capacity.

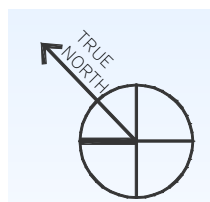
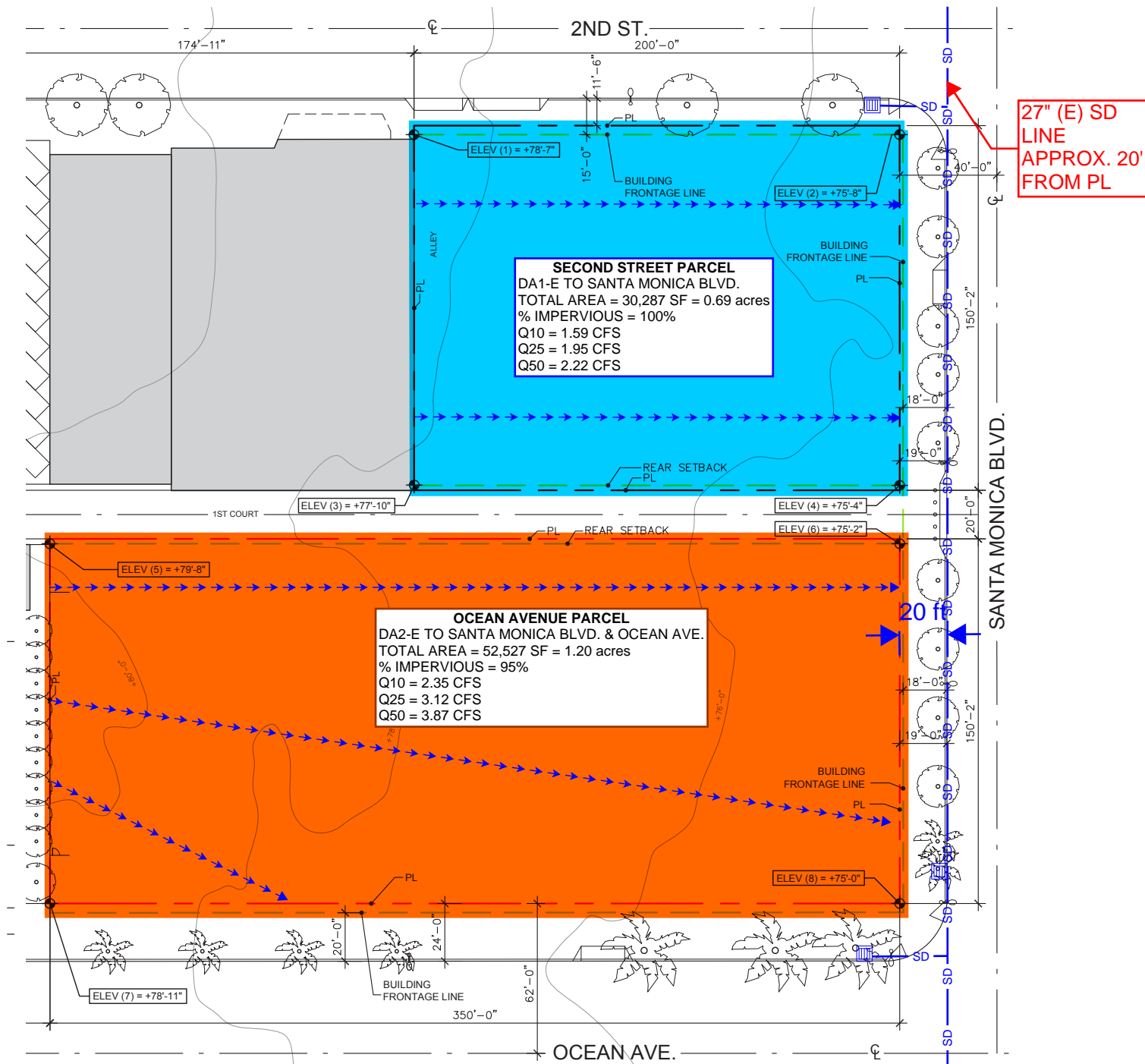
These conclusions were made based on the following assumptions: the total drainage area for hydrology analysis is based on the extent of the proposed development, the proposed development was analyzed as a standalone drainage area and upstream drainage areas tributary to the catch basin on Ocean Avenue and Santa Monica Boulevard were not analyzed as a part of this hydrology study, and run-on is not taken into account because it is not expected. We further understand that a portion of public alley between the Ocean Avenue Parcel and the Second Street Parcel will be redeveloped. This portion of the alley was not analyzed in this report because drainage patterns and impervious percentages are assumed to stay consistent with existing conditions.



Exhibit 1

Existing Hydrology

EXISTING DRAINAGE EXHIBIT



NTS

LEGEND



EXISTING DRAINAGE AREA #1



EXISTING DRAINAGE AREA #2

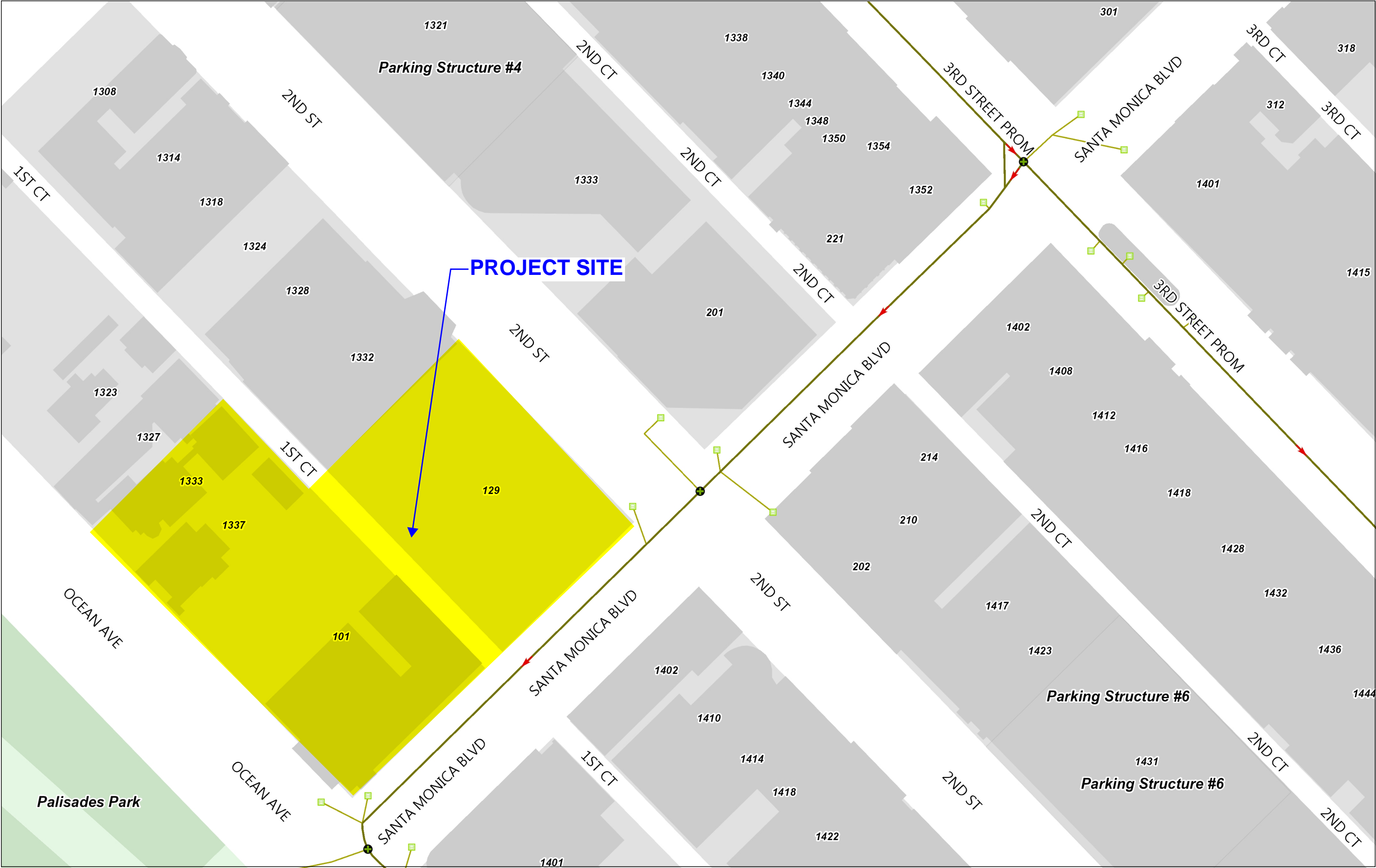
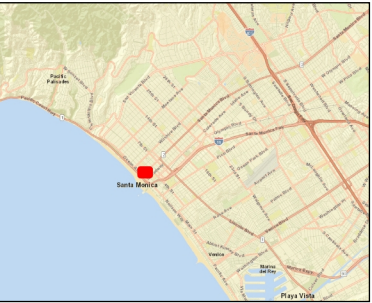


FLOW PATH



101 Santa Monica Blvd. - GIS Storm Drain map

EXISTING STORM DRAIN SYSTEM EXHIBIT



- Storm Manhole
- Santa Monica
 - LA County
 - CalTrans
- Storm CatchBasin
- Santa Monica
 - LA County
 - LA City
 - CalTrans
 - Private
- Storm Flow
- Storm TreatmentTank
 - Storm DischargePoint
 - Storm GravityMain
 - Storm LateralLine
 - Storm Abandoned
 - Abandoned Main
 - Future Main
- CSMENT.DBO.expo_stations
- CSMENT.DBO.expo_line
 - City Boundary



1: 1,128



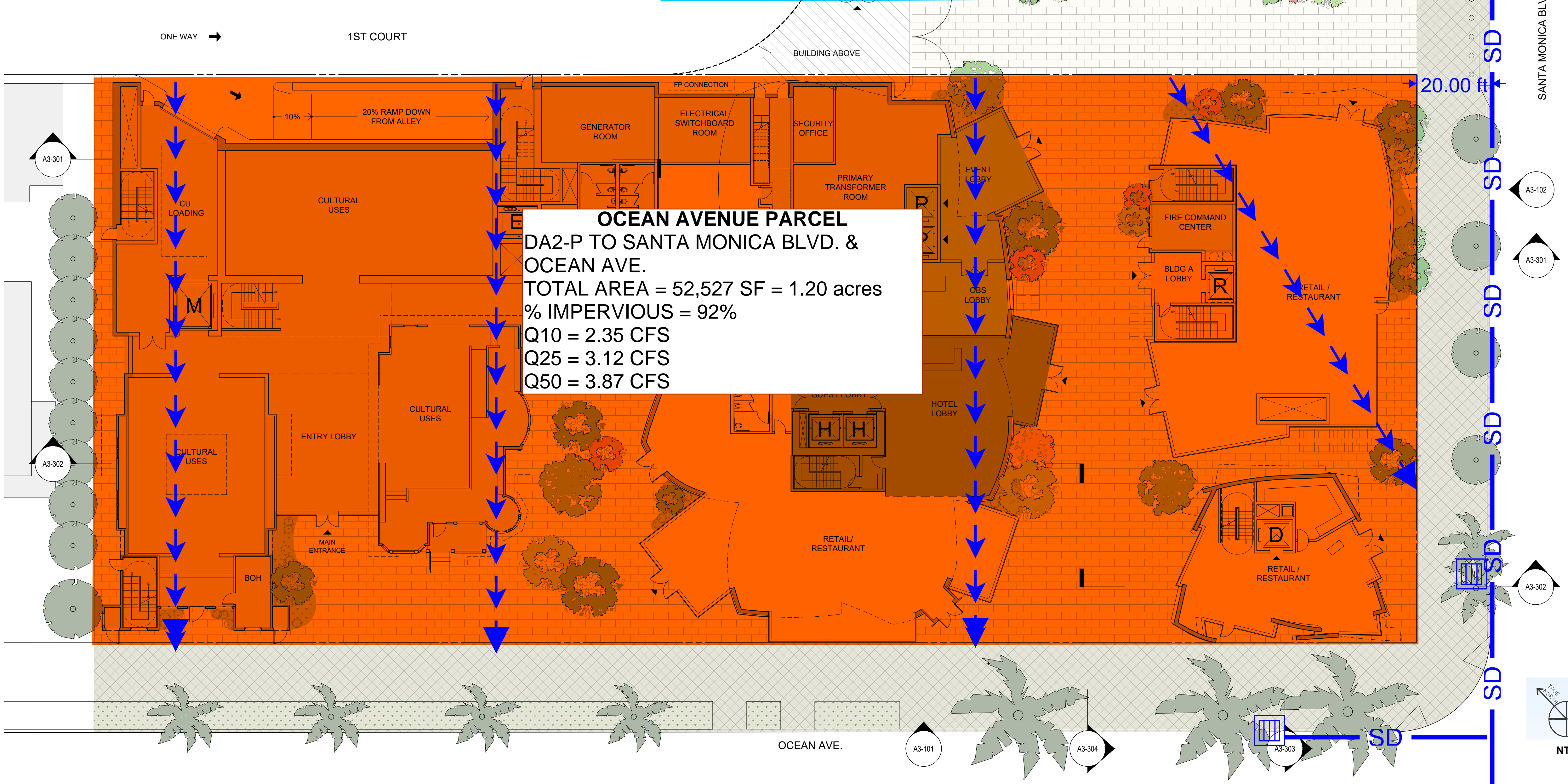
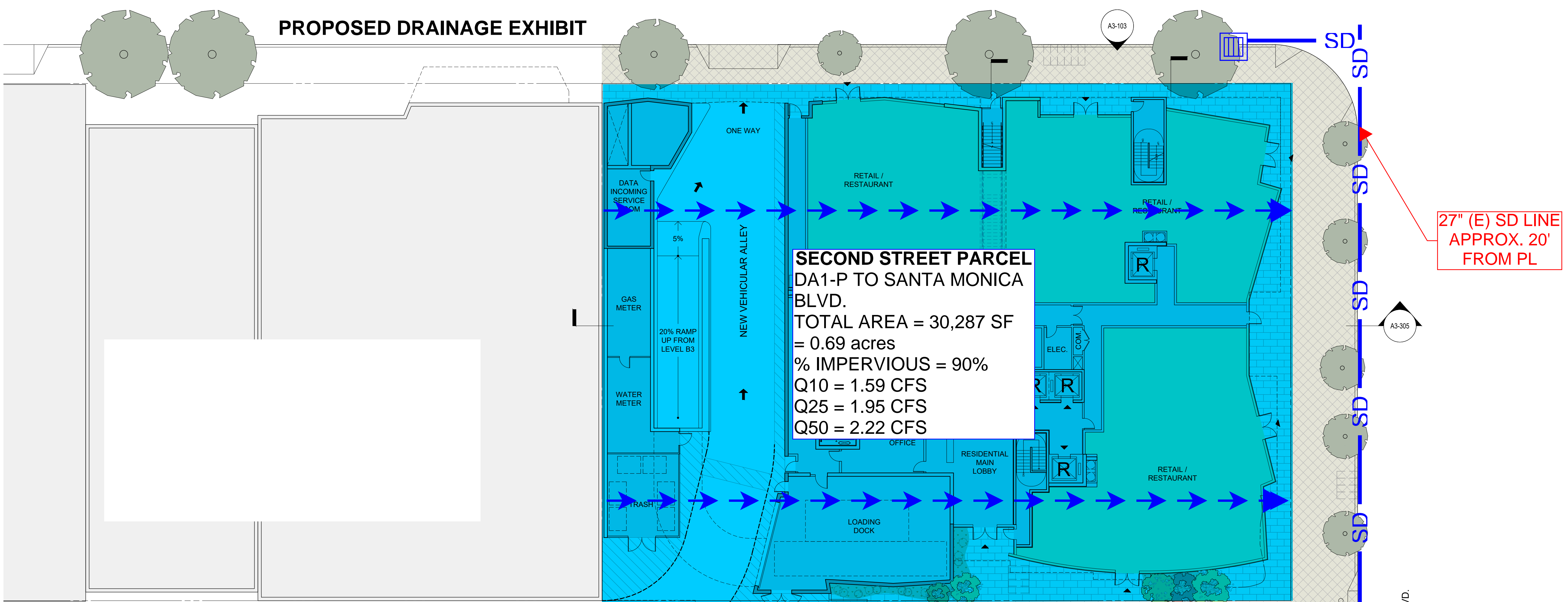
Disclaimer: This map of the City of Santa Monica has been provided for illustration purposes only. Every reasonable effort has been made to ensure the accuracy of the maps provided, however, some information may not be accurate. The City of Santa Monica ("City") provides this map on an "AS IS" basis. The City assumes no liability for damages arising from errors or omissions. THE MAPS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, either expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Do not make any business decisions based on this map before validating your decision with the appropriate City office.



Exhibit 2

Proposed Hydrology

PROPOSED DRAINAGE EXHIBIT



LEGEND

- PROPOSED DRAINAGE AREA #1
- PROPOSED DRAINAGE AREA #2
- FLOW PATH



Appendix A

Los Angeles County Soils Classification and Isohyetal Map



Appendix B

HydroCalc Peak Flow Hydrologic Analysis (10, 25 & 50-yr Existing)

Peak Flow Hydrologic Analysis

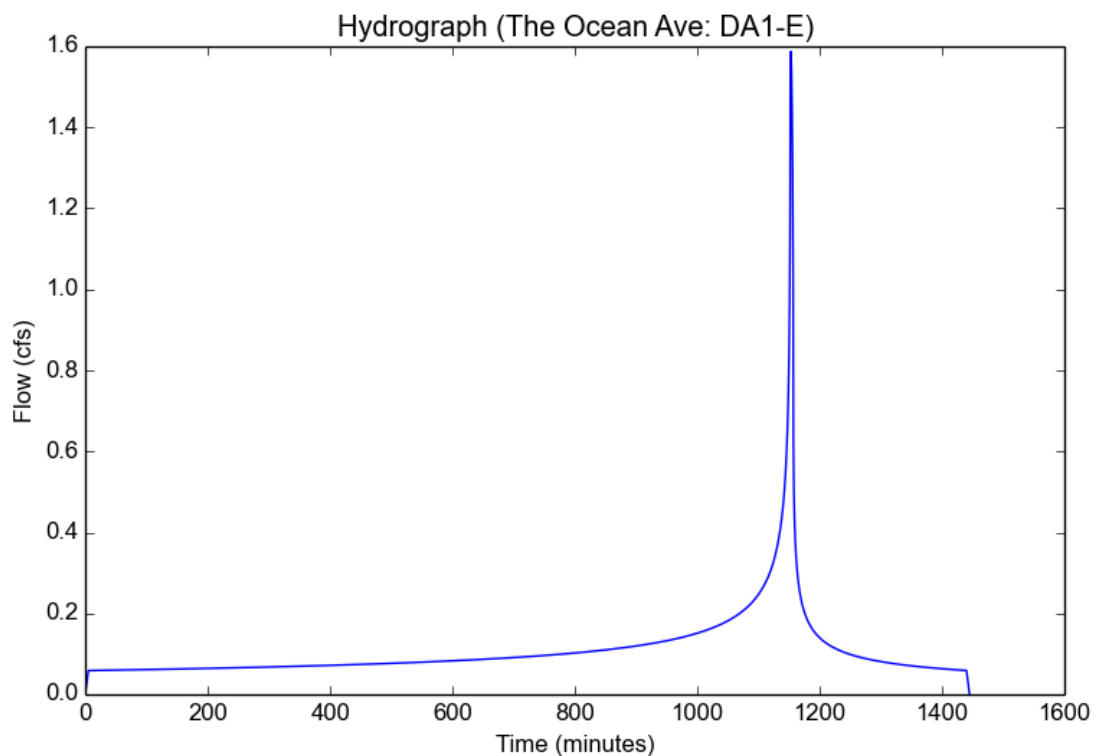
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA1-E
Area (ac)	0.69
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.015
50-yr Rainfall Depth (in)	6.0
Percent Impervious	1.0
Soil Type	13
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.284
Peak Intensity (in/hr)	2.556
Undeveloped Runoff Coefficient (Cu)	0.8949
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.5872
Burned Peak Flow Rate (cfs)	1.5872
24-Hr Clear Runoff Volume (ac-ft)	0.2199
24-Hr Clear Runoff Volume (cu-ft)	9577.3134



Peak Flow Hydrologic Analysis

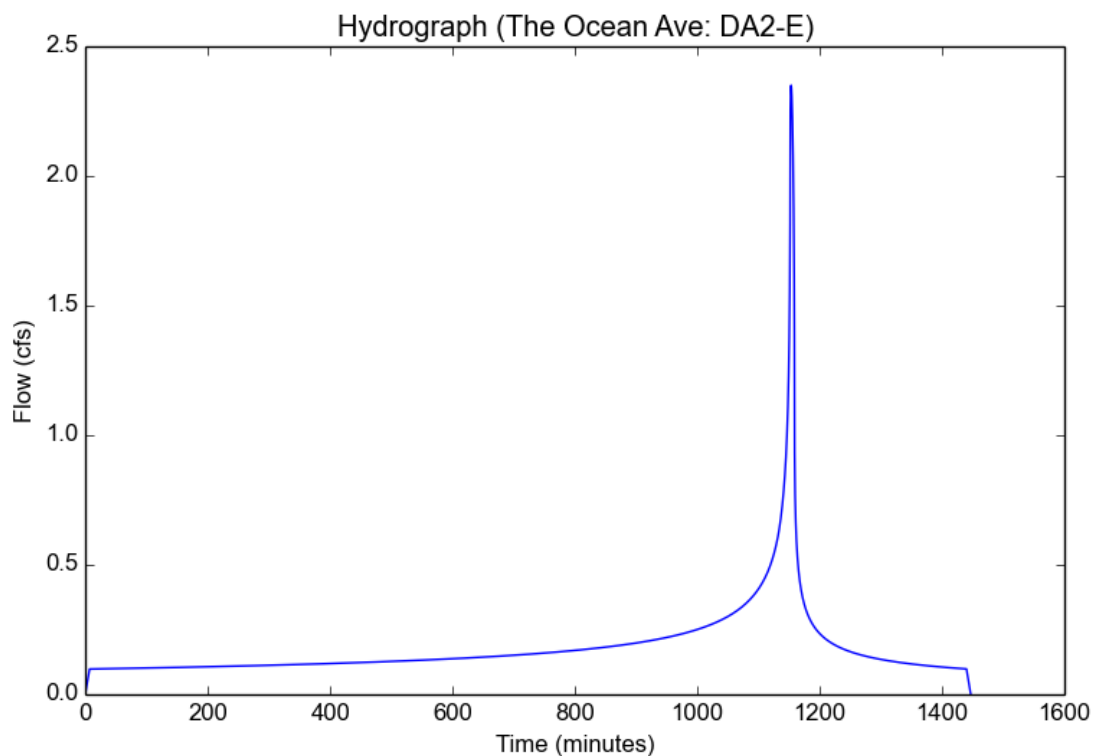
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA2-E
Area (ac)	1.2
Flow Path Length (ft)	350.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.95
Soil Type	13
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.284
Peak Intensity (in/hr)	2.1821
Undeveloped Runoff Coefficient (Cu)	0.8492
Developed Runoff Coefficient (Cd)	0.8975
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	2.35
Burned Peak Flow Rate (cfs)	2.35
24-Hr Clear Runoff Volume (ac-ft)	0.3666
24-Hr Clear Runoff Volume (cu-ft)	15969.5594



Peak Flow Hydrologic Analysis

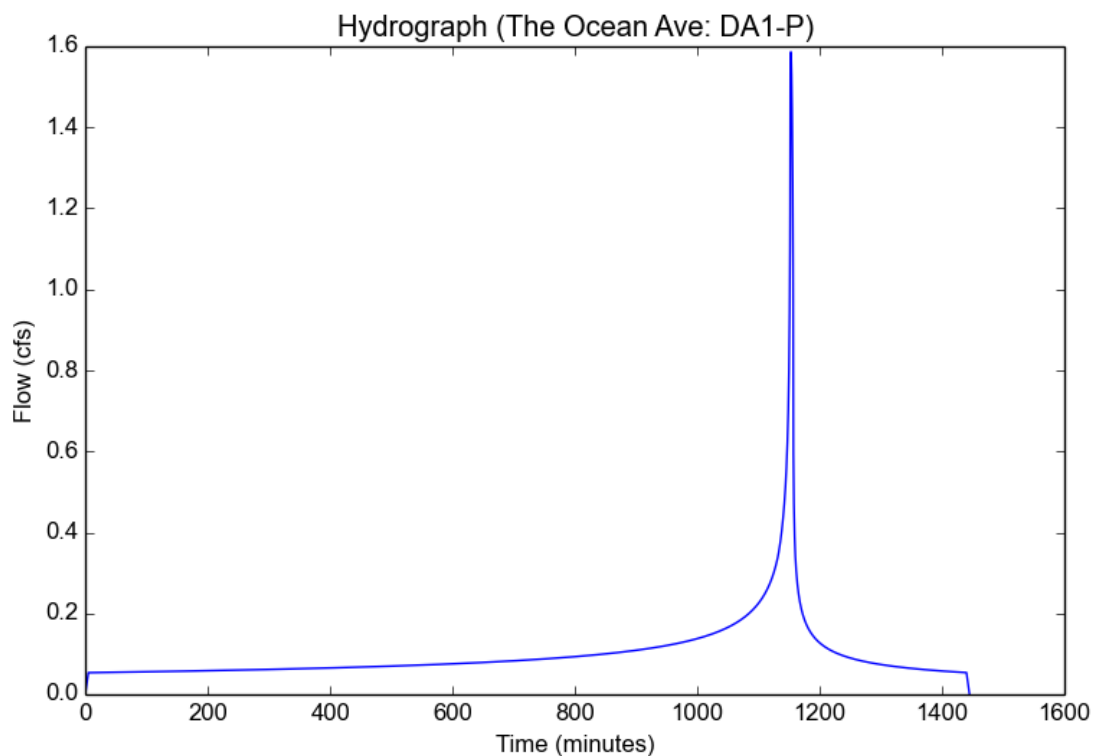
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA1-P
Area (ac)	0.69
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.015
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.9
Soil Type	13
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.284
Peak Intensity (in/hr)	2.556
Undeveloped Runoff Coefficient (Cu)	0.8949
Developed Runoff Coefficient (Cd)	0.8995
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.5864
Burned Peak Flow Rate (cfs)	1.5864
24-Hr Clear Runoff Volume (ac-ft)	0.2017
24-Hr Clear Runoff Volume (cu-ft)	8788.0795



Peak Flow Hydrologic Analysis

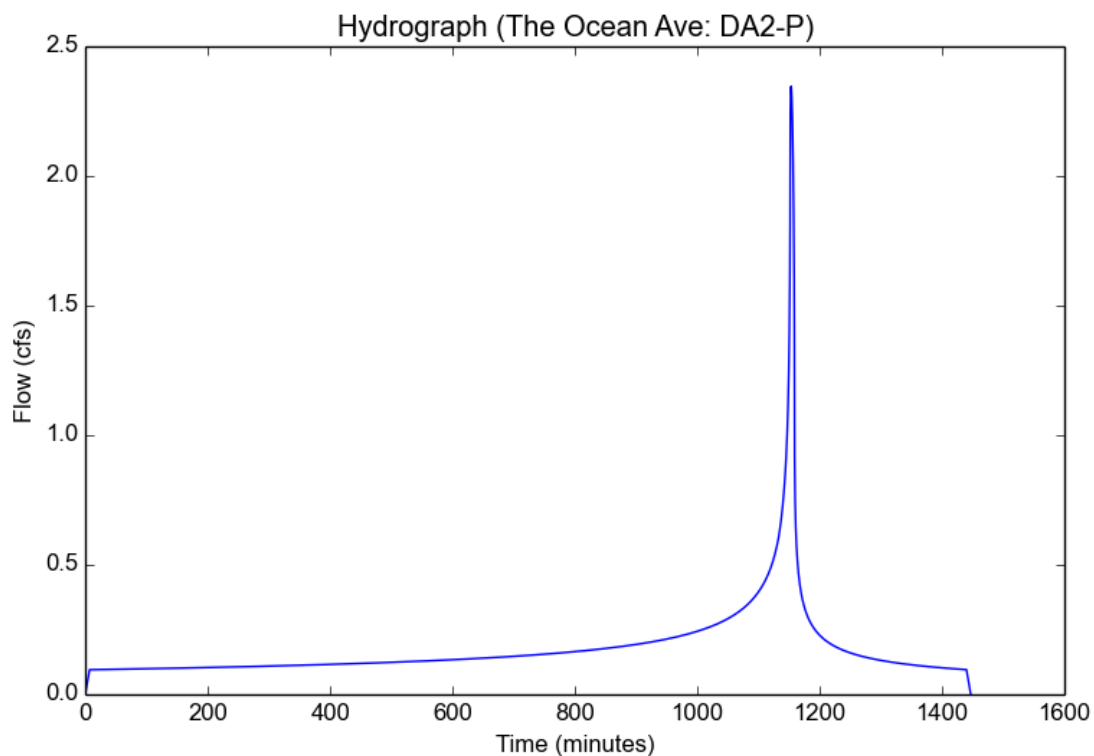
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA2-P
Area (ac)	1.2
Flow Path Length (ft)	350.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.92
Soil Type	13
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.284
Peak Intensity (in/hr)	2.1821
Undeveloped Runoff Coefficient (Cu)	0.8492
Developed Runoff Coefficient (Cd)	0.8959
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	2.346
Burned Peak Flow Rate (cfs)	2.346
24-Hr Clear Runoff Volume (ac-ft)	0.3572
24-Hr Clear Runoff Volume (cu-ft)	15557.5736



Peak Flow Hydrologic Analysis

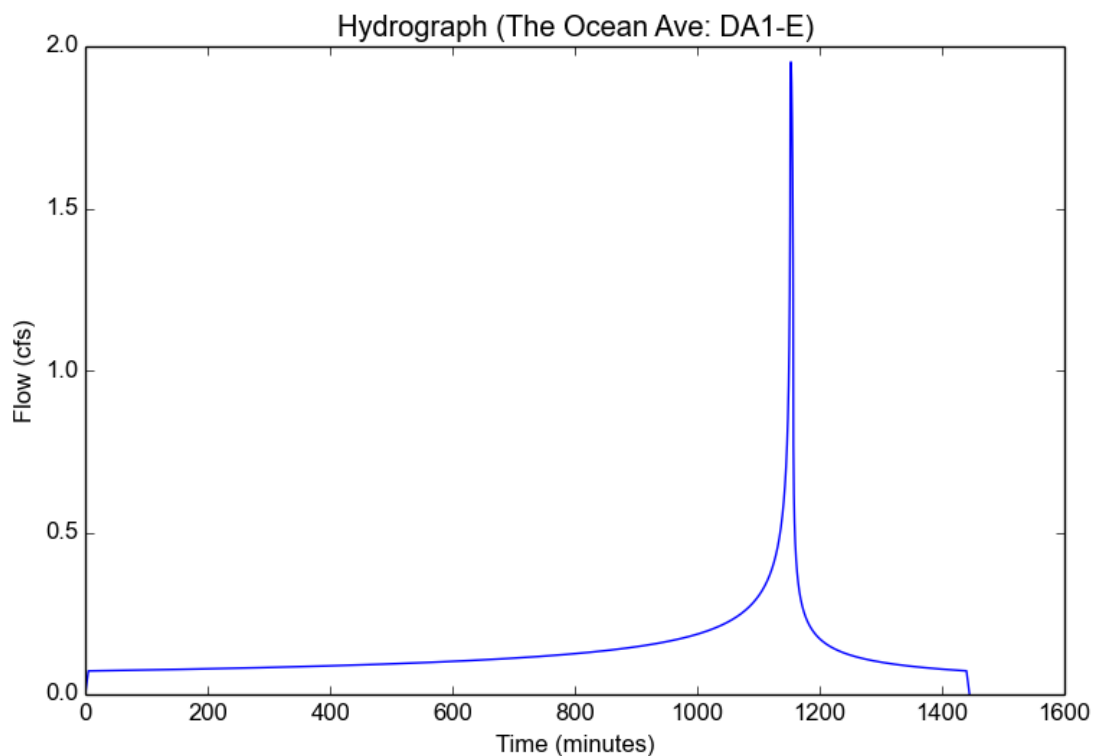
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Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA1-E
Area (ac)	0.69
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.015
50-yr Rainfall Depth (in)	6.0
Percent Impervious	1.0
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.268
Peak Intensity (in/hr)	3.143
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.9518
Burned Peak Flow Rate (cfs)	1.9518
24-Hr Clear Runoff Volume (ac-ft)	0.2704
24-Hr Clear Runoff Volume (cu-ft)	11777.1445



Peak Flow Hydrologic Analysis

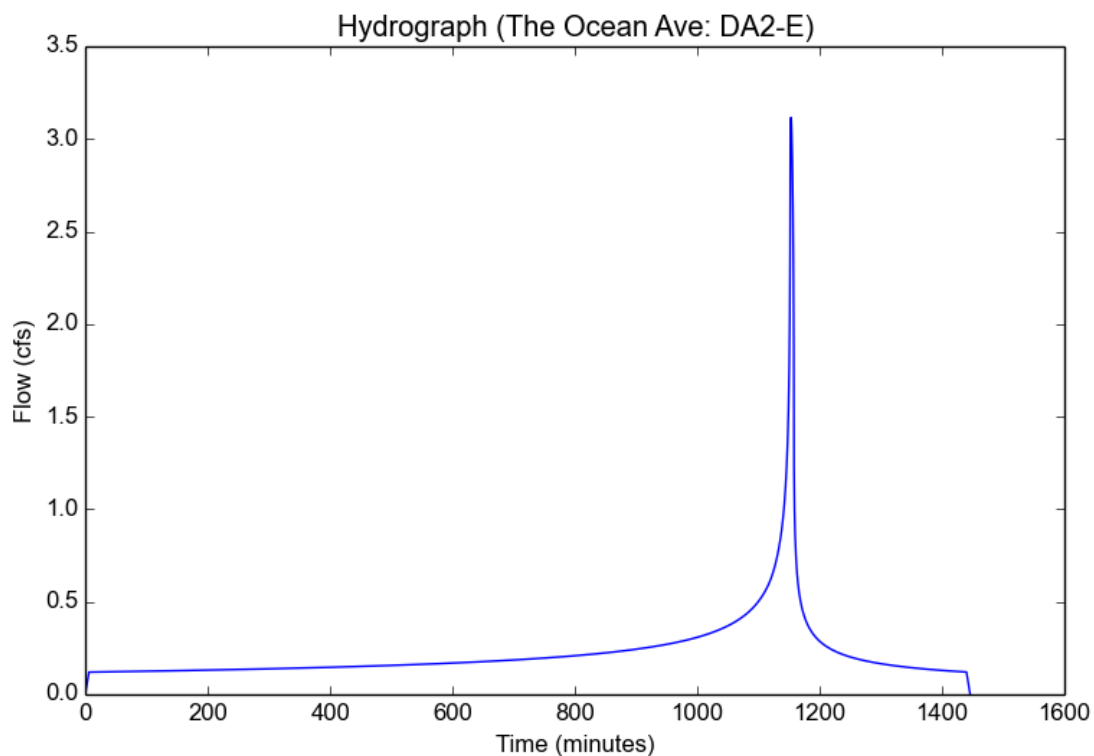
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Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA2-E
Area (ac)	1.2
Flow Path Length (ft)	350.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.95
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.268
Peak Intensity (in/hr)	2.8849
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	3.1157
Burned Peak Flow Rate (cfs)	3.1157
24-Hr Clear Runoff Volume (ac-ft)	0.4512
24-Hr Clear Runoff Volume (cu-ft)	19654.9734



Peak Flow Hydrologic Analysis

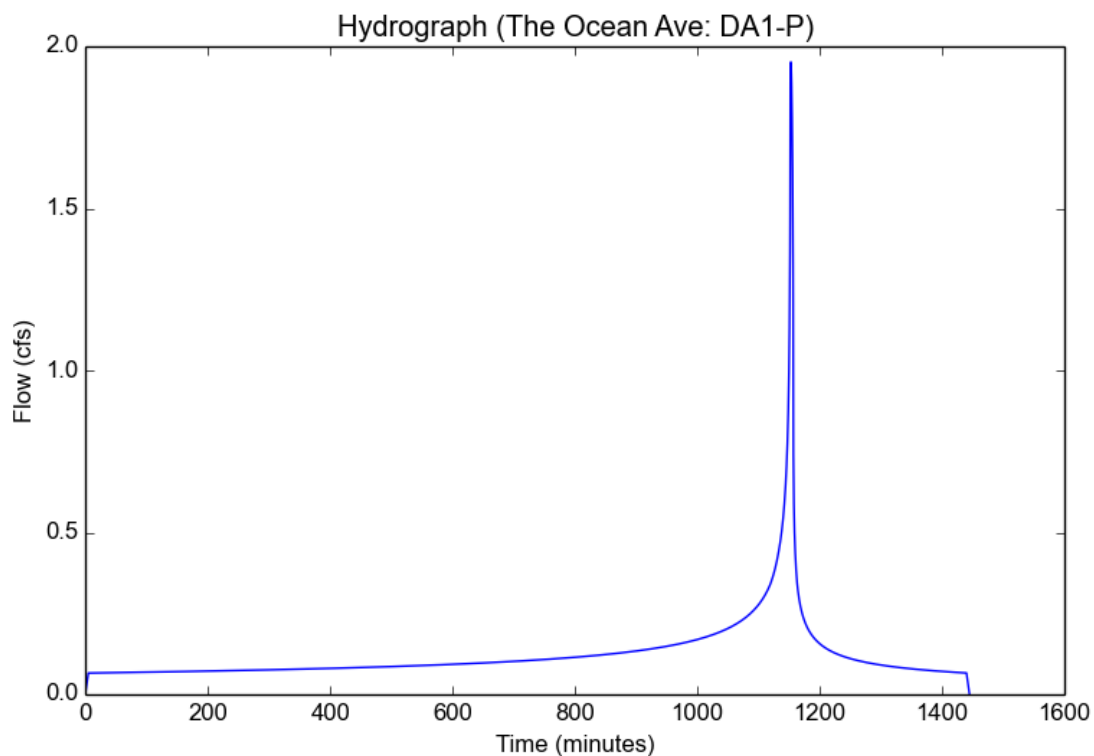
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA1-P
Area (ac)	0.69
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.015
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.9
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.268
Peak Intensity (in/hr)	3.143
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.9518
Burned Peak Flow Rate (cfs)	1.9518
24-Hr Clear Runoff Volume (ac-ft)	0.2485
24-Hr Clear Runoff Volume (cu-ft)	10825.3318



Peak Flow Hydrologic Analysis

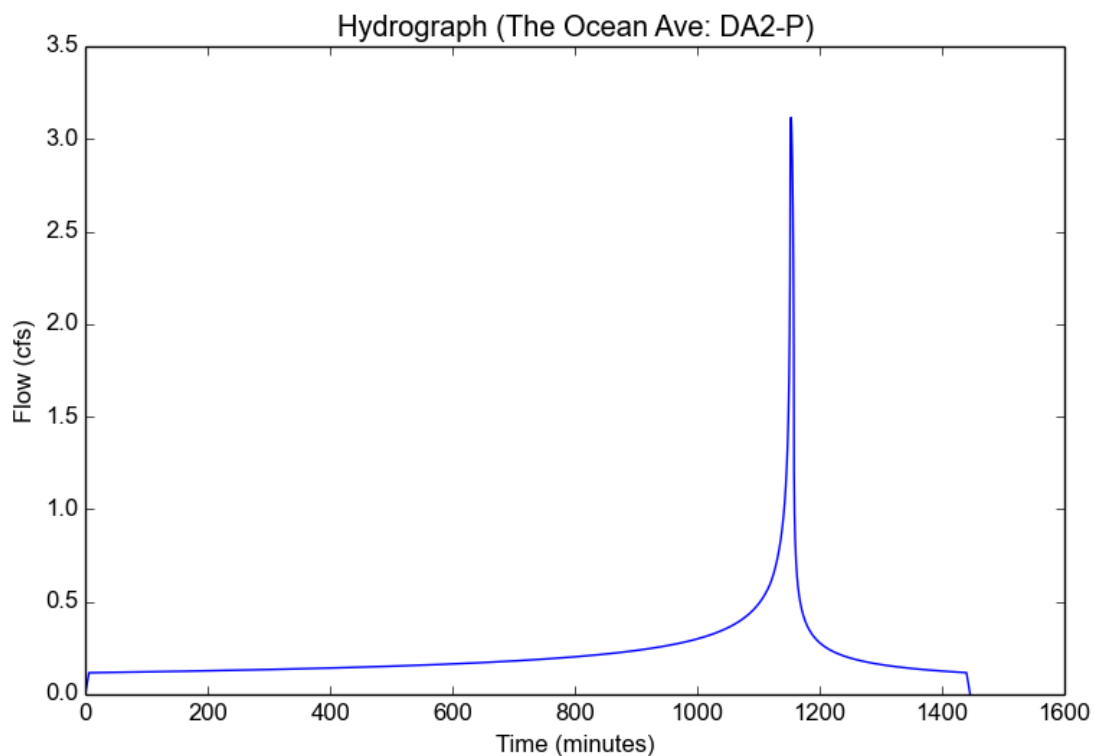
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA2-P
Area (ac)	1.2
Flow Path Length (ft)	350.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.92
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.268
Peak Intensity (in/hr)	2.8849
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	3.1157
Burned Peak Flow Rate (cfs)	3.1157
24-Hr Clear Runoff Volume (ac-ft)	0.4398
24-Hr Clear Runoff Volume (cu-ft)	19158.7616



Peak Flow Hydrologic Analysis

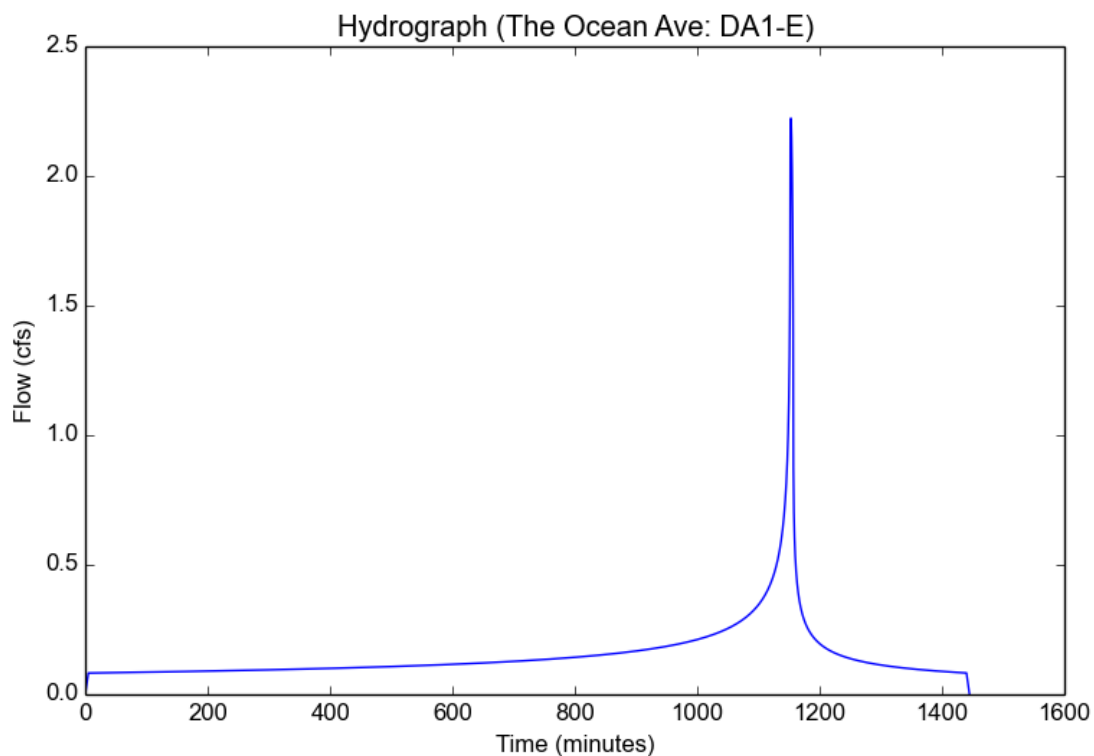
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Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA1-E
Area (ac)	0.69
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.015
50-yr Rainfall Depth (in)	6.0
Percent Impervious	1.0
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.0
Peak Intensity (in/hr)	3.5798
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.223
Burned Peak Flow Rate (cfs)	2.223
24-Hr Clear Runoff Volume (ac-ft)	0.3079
24-Hr Clear Runoff Volume (cu-ft)	13413.6042



Peak Flow Hydrologic Analysis

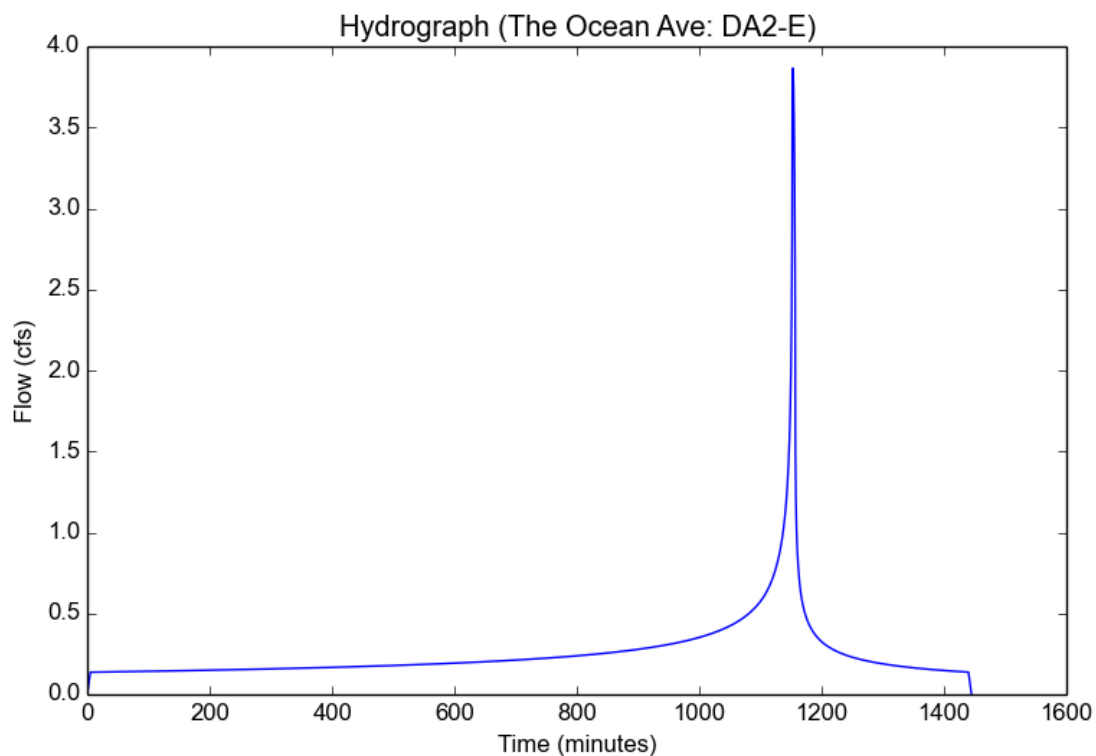
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Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA2-E
Area (ac)	1.2
Flow Path Length (ft)	350.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.95
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.0
Peak Intensity (in/hr)	3.5798
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.8661
Burned Peak Flow Rate (cfs)	3.8661
24-Hr Clear Runoff Volume (ac-ft)	0.5142
24-Hr Clear Runoff Volume (cu-ft)	22399.0422



Peak Flow Hydrologic Analysis

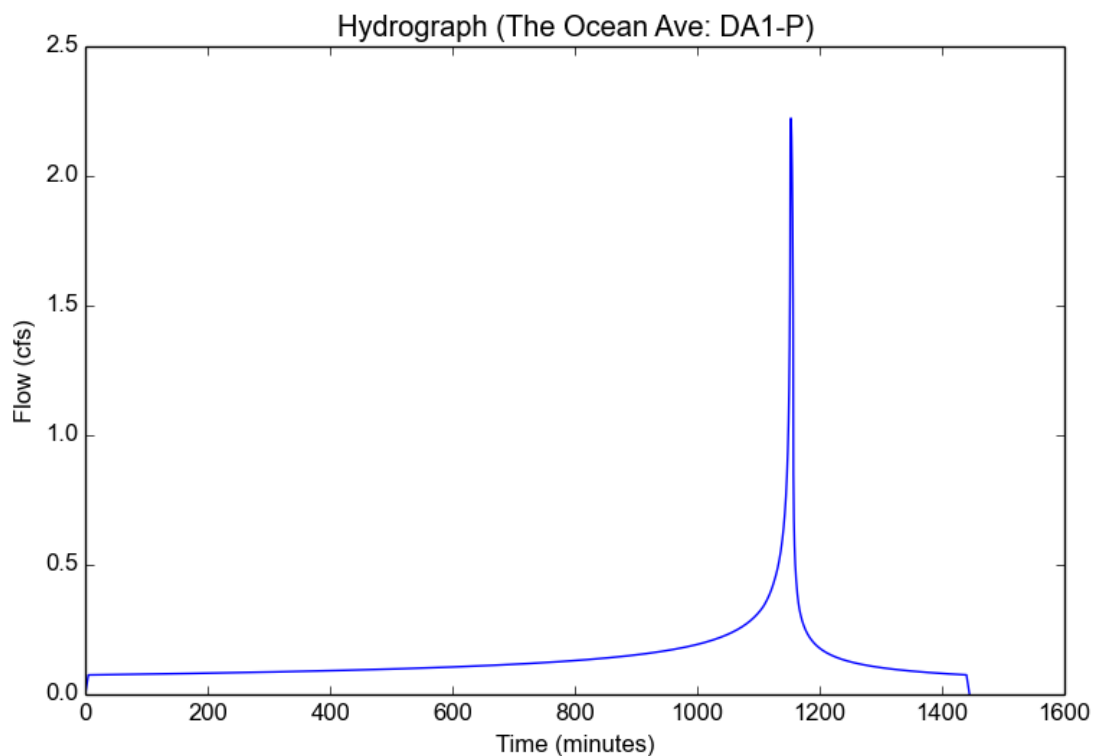
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Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA1-P
Area (ac)	0.69
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.015
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.9
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.0
Peak Intensity (in/hr)	3.5798
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.223
Burned Peak Flow Rate (cfs)	2.223
24-Hr Clear Runoff Volume (ac-ft)	0.2834
24-Hr Clear Runoff Volume (cu-ft)	12345.2943



Peak Flow Hydrologic Analysis

File location: P:/2018/1800134 The Ocean Ave/ENGR/STORM/Supporting Documents/2019-07-05 HydroCalc Results.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	The Ocean Ave
Subarea ID	DA2-P
Area (ac)	1.2
Flow Path Length (ft)	350.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	6.0
Percent Impervious	0.92
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.0
Peak Intensity (in/hr)	3.5798
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.8661
Burned Peak Flow Rate (cfs)	3.8661
24-Hr Clear Runoff Volume (ac-ft)	0.5014
24-Hr Clear Runoff Volume (cu-ft)	21841.6631

